Interference No. 44255

IN THE

United States Patent Office

Before the Law Examiner

SCHNEIBLE

VS.

BLOCK.

Memorandum on Behalf of Schneible on Motion to Dissolve.

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SCHNEIBLE,		Interference
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BLOCK.		

MEMORANDUM ON BEHALF OF SCHNEIBLE ON MOTION TO DISSOLVE.

The three counts of the present interference are claims 1, 2 and 4 of Schneible's issued patent No. 1311421. Since the counts have been adopted by Block from this issued patent, they must be interpreted in accordance with the Schneible patent, and the prime question at issue is whether Block has a right to make these claims when so interpreted. The counts are as follows:

Count 1:

Manufacturing ethyl alcohol and residue for beverage from fermented liquor by distilling the liquor, freeing the high boiling products from the alcoholic vapors, exhausting the vapors of ethyl alcohol and low-boiling-point products and withdrawing the residue of distillation containing the high-boiling-point products for beverage.

Count 2:

Manufacturing ethyl alcohol and residue for beverage from fermented liquor by distilling the liquor, freeing the high boiling products from the alcoholic vapors, exhausting the vapors of ethyl alcohol and low-boiling-point products from the still, condensing the ethyl alcohol, and withdrawing the residue of distillation containing the high-boiling-point products for beverage.

Count 3:

Manufacturing ethyl alcohol and residue-liquid for beverage from fermented liquor, by subjecting the liquor to distilling conditions, freeing the high-boiling point products from the alcoholic vapors, exhausting the vapors of ethyl alcohol and low-boiling-point products, mingling the phlegm and its contained high-boiling-point products with the distilling liquor and withdrawing the residue of distillation with the high-boiling-point products therein contained for beverage.

The essentially novel point in the counts is that in distilling the fermented liquor (in practice up-to-date ordinary beer), the "high-boiling-point products" are freed from the alcoholic vapors, and are returned to the residue which is the beverage ultimately consumed, the alcohol freed from the "high boiling products" being in the commercial practice of the process a by-product, in the sense that the residue beverage (de-alcoholized beer) is the product of principal value, for the sake of which the process is really carried on.

It is most important at the very outset to appreciate the full meaning of these counts. They were drawn with the utmost care, to distinguish from a known prior art almost identical with Block's disclosure, and their meaning must be fully grasped before turning to an analysis of the Block process. It is, of course, obvious that in the distillation of a fermented liquor, such as beer containing, say, 3½% alcohol, to an extent necessary to drive off enough alcohol to bring the residue below ½ of 1%, as required by law, an enormous amount of water will necessarily pass off with the alcohol. This is, of course, elementary in all distillation processes, and it is well understood that in order to secure anything like a satisfactory separation of water and ethyl alcohol, repeated distillation must be practiced,

in each of which the distillate will be somewhat higher in alcohol and lower in water than was the charge. This separation of water and alcohol can be carried out by the common laboratory methods of repeated fractionation, or by the use of the well known column still, in which the rising vapors are repeatedly condensed and re-evaporated as they rise, so that ultimately relatively pure alcohol can be obtained from the upper end of the still, the water returning to the beer. It is known in the art that if ordinary beer be simply boiled to an extent necessary to bring the ethyl alcohol content down to the legal standard, nearly 40% volume will pass off as vapor, of which, of course, about 3 or 3½% will be alcoholic vapors and the remainder will be mostly water vapors. The essential point of the Schneible patent lies in the fact that from this relatively large body of vapors, there is separated out something which the claims refer to as "high boiling products," and this is returned to the residue. Thus, without turning to the specification at all, we find that the phrase "high boiling products," is partially defined. These "high boiling products" must be distillable in the sense that they pass out of the beer and temporarily exist in the vapor phase. They must be high in boiling point with reference to the ethyl alcohol, and they must be of a character such

that they can be separated out of the vapors and returned.

Of course, beer contains a very large amount of totally non-distillable ingredients which never leave it in vapor form, and, consequently, never can be separated out and returned. Ordinary alcohol-reduced beers, made by simply boiling the beer and replacing the loss with water, contain all of these non-distillable ingredients. Among these may be mentioned sugars, albumens, dextrines, and, in fact, practically all of the useful ingredients of the beer. In point of fact, the amount of distillable matter which can be separated from the vapors and returned, is most minute in quantity, but the basis of the Schneible patent is solely the segregation and return of this extremely small fraction.

When we turn back to the specification, we find exactly what these "high boiling products" are. In the statement of invention, page 1, lines 17-21, it is stated that the residue liquor

> "shall not only contain the remaining extract matter of the fermented mash, wort or must in unimpaired condition, *but also the volatile products of fermentation.*"

The remaining extract matter first referred to is the non-distillable part of the beer, while the volatile products of fermentation are the "high boiling pro-

ducts'' of the counts. In their first mention in the specification, these ''high boiling products'' are referred to as *products of fermentation.* Throughout the remainder of the specification, and in the claims, they are referred to merely as products, since, when once identified as products of fermentation, a further repetition of the more cumbersome phrase is superfluous.

It thus appears that the ''high boiling products'' referred to in the claims, not only are distillable, but are products of the fermentation occurring in the beer before the present process begins.

Now, to one skilled in the art to which this invention relates, it is entirely apparent just what these distillable products of fermentation of higher boiling point than ethyl alcohol necessarily and unmistakably are. These substances are so small in percentage in beer that their presence has been largely ignored in beer literature, but since they become concentrated in whisky by the processes of distillation, they have in that art been most carefully analyzed, and, since the initial fermentation both of beer and of a whisky mash, is identical, most complete information as to the character of these bodies can be found in the whisky literature.

A simple discussion of these bodies is found in the book of Harvey W. Wiley, M. D., on ''Beverages

and Their Adulteration,'' pp. 279-81. By referring to this article it will be observed that Dr. Wiley states the recognized fact that the higher alcohols, and analogous products, are actually *formed by the fermentation of the malted starch,* precisely the same material which exists in beer, and it is, of course, obvious, therefore, that these are the ''high boiling products'' referred to.

In the extensive hearings under the Pure Food Laws, relative to the labeling of the various so-called whiskies, these various fermentation products came to be known as ''congeneric substances,'' and were so referred to throughout the hearings.

Practically speaking, these congeneric substances differ only minutely from what is called fusel oil. They may be divided into two general groups, those of lower boiling point, and those of higher point than ethyl alcohol. In the subsequent purification of alcohol, the congeneric substances of higher boiling point than ethyl alcohol would remain behind upon rectification, and would form the group commonly known as fusel oil. The more volatile materials of lower boiling point are minute in quantity, the main congeneric substances being the three higher alcohols, butyl, propyl and amyl alcohol, of which the latter is the principal and these congeneric substances of higher boiling point constitute fusel oil.

In the Schneible patent it is clearly stated, not only in the specification but in the claims, that it is only the high boiling products which are separated from the vapors and returned to the residue beverage, while the lighter, etheric substances pass away with the ethyl alcohol vapors.

Briefly stated, therefore, the Schneible patent clearly sets forth that the intent and purpose of the inventor is to separate out of the distilling vapors the fusel oil, and to return this to the beverage while removing both the ethyl alcohol and those products of fermentation, or those congeneric substances which are more volatile and of lower boiling point than ethyl alcohol. The essence of the claims involved is the separation and return of the fusel oil, and the question we must now consider is whether Block has a right to make claims based on that action.

The Schneible patent having issued, and, therefore, being not open to attack on the grounds of operativeness, it is, of course, unnecessary to show that Schneible's described manipulation will secure the result he sets forth. It is not open to Block to assert that Schneible does not get the result he claims to get. However, in order to show fully that Block does not and cannot secure the result Schneible claims to secure, it will subsequently become necessary to compare the two processes in order to avoid the argu-

ment that since Schneible gets the result, Block must also get it. Initially, however, we will consider Block's disclosure alone.

Block's process consists in distilling beer through an ordinary distiller's still, of the continuous type, under a high vacuum. The still differs in no essential respect from stills normally used in the whisky art, such a still, although a better type than Block's, being shown at the left of Fig. 10, p. 67, of a pamphlet of the U. S. Department of Agriculture, entitled, "Manufacture of Denatured Alcohol," by H. W. Wiley, then Chief of the Bureau of Chemistry. It is perfectly notorious that a still of that type as normally used, produces as a distillate exactly what Block sets forth in his specification, and in his claims not in interference, that is, a distillate which is about 50% water and 50% alcohol. Block recognizes the fact, already stated, that in the ordinary boiling of beer to reduce its ethyl alcohol content to the legal standard, a very large quantity of water will pass off also, his statement being that from 40 to 70% of the liquid is withdrawn. He states (p. 2, line 8) that he desires to remove the alcohol in a "reasonably concentrated form." He also states (p. 5, lines 15 and 16) that the amount of liquid other than alcohol taken over from the rectifying column, will be exceedingly small, but this evidently means small

with reference to the 40 to 70%, which would otherwise be taken over. On p. 7, line 7, he speaks of taking over nearly pure alcohol vapors. All these statements, however, are general and indefinite. His definite statement is found on p. 8, lines 4-8, where he says that he withdraws but a small percentage of water, which will probably be abount 3%, or about three barrels for every 100 barrels of wort. (The verbiage of this part of the Block specification was changed by amendment, but the substance is the same.) Of course, starting with beer of about 3½% alcohol by volume (slightly less by weight), and reducing to the legal standard of less than ½ of 1% alcohol, would take off about 3% alcohol by volume, and, since Block takes off a like quantity of water, his distillate will be about 50-50, or slightly less (because of the difference in proportion by weight and volume), which is exactly the strength and composition of ordinary whisky. In addition, claims 1, 2 and 5, of the amendment of May 1, 1919, specify that the water and alcohol in the distillate shall be in equal proportion. Furthermore, the Examiner's action of June 20, 1919, points out that the Block apparatus is substantially that used in the distillation of alcohol from a mash. Finally, of the Block claims now in his case, claims 1, 2, 4 and 8 specify that the distillate shall contain water equal in quantity to the

alcohol. In other words, the Block process is perfectly and clearly described as a process which makes a whisky distillate.

On the contrary, the Schneible patent clearly discloses a rectifying column containing a very much larger number of pans than does Block's, so that in passing therethrough, the vapors will be subjected to a much greater number of re-distillations, and Schneible expressly states (p. 3, line 45) that his distillate alcohol is always above 90%, and usually above 97% pure, and he further says (p. 3, lines 105 to 110) that it is important to have the alcohol distillate above 90%, because until a strength of 80 to 85% has been attained, some of the most valuable aromatic bodies do not appear to separate from the vapors.

Of course, there is no difficulty in building a fractionating column with enough pans to get any desired degree of separation between alcohol and water. Block, however, discloses a column producing 50% alcohol, which is ordinary whisky, while Schneible discloses a column producing upwards of 90% alcohol, and he states expressly that until approximately this concentration is attained, the separation of the "high boiling products" of his claims cannot be produced. Of course, it is conceded that any mechanic skilled in this art could devise a col-

umn still with sufficient rectifying capacity to produce either 50% alcohol, or 85% alcohol, or 90% alcohol, just as he chose. The essential point is, that Schneible states that the process of his claims cannot be carried out except with a still producing about 90% alcohol as a distillate, while Block's process is carried out with a still which produces a 50% alcohol distillate.

This brings us to the first outstanding question in the case. Block, it is true, states, in criticizing the prior art, that in the boiling off of 40 to 70% of the liquid in the beer and its displacement by distilled water, certain flavors are lost, which, it may be inferred, are intended to be retained in the beer by his process, but there is not a syllable of verbal disclosure in his application of separating out of the vapors any particular fractions and returning them to the residue beverage.

The first question, therefore, is whether in a rather abstruse field, Block should not be denied the right to make the claims simply and solely by reason of the total absence of disclosure, more especially since his process is one which Schneible states in his specification will not attain the desired result set forth in the counts. Even if it transpired that Block's process actually did produce the results claimed, it is submitted that under the circumstances

he would not be entitled to make these claims, for it is perfectly settled that in order to make the claims, he must disclose their subject matter with such accuracy as to enable one skilled in the art to practice the process of the counts without experiment. The courts have often had occasion to pass upon undisclosed and accidentally present matter in a patent, as for instance, in *Gray* v. *Baird,* 174 Fed., 417, and *Mosler* v. *Lurie,* 209 Fed., 364, 366-7.

It has uniformly been held in recent years that the accidental presence of an unappreciated point, without sufficient disclosure to enable a mechanic skilled in the art to appreciate its presence or its value, is not a reference, for the reason that the description is not of a kind to lead one to practice the invention. It is perfectly clear that had the Block application issued without the counts in issue, say five years ago, it would not be a bar to the present claims of Schneible, even if it appeared, upon careful test, that the Block process incidentally and accidentally attained the Schneible result.

It would seem clear that to make the counts, Block ought to have at least sufficient disclosure that, had his patent issued, it would have anticipated the counts. And it is perfectly evident to anyone having experience with modern trials in patent causes that the Block application, devoid as it is of any

verbal disclosure of the Schneible process and containing a description of one step (removing water equal in quantity to the alcohol) which Schneible states would be fatal to his process, could in no sense be a reference to the counts.

It must be borne in mind that the Schneible patent has issued, and that this proceeding can never be finished in Block's favor until there is an interfering patents suit determined. There is probably no Court of Appeals in America which would not instantly hold that the mere accidental and unappreciated occurrence of the Schneible result in the Block process (even if it were present, which it is not), was not a reference to the Schneible claims. On this ground alone, therefore, it is submitted that the interference should be dissolved. It may be suggested that this is the simplest method of disposing of the case, since it avoids the close study of fractional distillation, to which we must presently address ourselves in demonstrating that the Block process, as disclosed, does not and cannot produce the Schneible result.

It is relatively easy to prove that Block does not have the Schneible result of separating from the vapors and returning to the beverage the "high boiling products" of fermentation which have already been shown to be, in common parlance, fusel oil. This can be disposed of as a pure and simple

question of fact. The abstruse part of the discussion arises when we begin to explain why Schneible really accomplishes his result, in order to meet the argument that Block must do what Schneible does. The fact is that Schneible claims to and does return the fusel oil and Block cannot return the fusel oil to the residue beverage. The difference arises, of course, from physical causes. These causes are quite capable of analysis and explanation, but they lead into realms which are somewhat abstruse, even to those well versed in the art, although the facts are well known. We shall, therefore, address ourselves first to the simple question of fact as to whether Block can and does produce the result set forth in the claims. If we show that he does not, it will be clear that the interference should be dissolved, leaving to the courts the question as to whether Schneible does or does not accomplish the result.

As has been already shown, Block's distillate is ordinary whisky, about 50% alcohol and 50% water. It is perfectly notorious that ordinary whisky, made in the ordinary way, does contain fusel oil, and, since the whisky is a distillate, fusel oil is not separated from the vapors and returned to the residue in the still, as required by the counts. Hundreds of analyses of different kinds of whisky are available in print. Wiley's book, for instance, on p. 318, gives the

analyses of a considerable number. These run from 80 to 110° proof, which is 40 to 55% alcohol. They contain from 100 to 300 parts of fusel oil per 100,000 of 100° proof alcohol. In other words, these commercial whiskies contain from 1/10 to 3/10 of 1% of these congeneric substances, principally the higher alcohols. On the other hand, the same table published by Dr. Wiley shows that neutral spirit of 190° proof, which is 95% alcohol, contains only 25 parts of fusel oil per 100,000 of 100° proof alcohol, which is from 1/4 to 1/2 as much as was present in the whiskies.

The pamphlet entitled, "A Study of the Changes Taking Place in Whisky Stored in Wood," reprinted from the Journal of the American Chemical Society, by Crampton and Tollman, shows the analyses of a very large number of whiskies. These tables are summarized on page 120, showing substantially the same percent of fusel oil in new whisky.

The description of the ordinary whisky processes of distillation make it perfectly apparent that it is impossible for Block to get anything but a distillate which is substantially whisky and contains the normal fusel oil content which was in the mash. For instance, Wiley's book points out (p. 312) that the distillation from the beer is usually conducted in two

stages, ultimately to bring the whisky up to a full 50% alcoholic strength. Since the Bubble Pan type of Column Still is very common, since all whiskies are of approximately 50% alcoholic strength, and since all whiskies not made by dilution from rectified spirits, show approximately the same fusel oil content, it can only be by some miracle that Block could help getting in his distillate exactly what everyone has always obtained from like apparatus and from like beers.

The cold fact is that any 50% alcoholic strength distillate contains the fusel oil, and all the art is perfectly familiar with the fact, and knows of no way to prevent it. It is equally known, and fully set forth in Wiley's book, that if the high wines, *i. e.*, whiskies, are rectified through a high-grade rectifying column and brought up to a high concentration of, say, 90% alcohol, the fusel oil will be left behind. Fusel oil is thus eliminated from alcohol at some point between a 50% strength and a 90% strength. This is the common process of rectification producing commercial alcohol, "cologne spirit," "velvet spirit," or "neutral spirit." This rectification is a wholly different step from the original making of the high wine or commercial whisky.

The whole gist of the Pure Food controversy over the labeling of whisky, arose from the fact that the

rectification, which is merely purifying from 50% alcoholic strength to 90% or higher alcoholic strength, eliminated the fusel oil from the whisky, and when whisky is made of the so-called rectified, or "cologne" spirit, it is diluted with an equal quantity of water and then colored and flavored to give an imitation whisky flavor, as closely resembling the characteristic flavor produced by the fusel oil in straight whisky as is possible. The contention of the Department of Agriculture was that nothing could properly be called whisky which does not contain the fusel oil and other so-called congeneric bodies, while the contention of the rectified whisky interests was that diluted spirit, from which the fusel oil has been removed by rectification, was clearly entitled to the cognomen. The history of the controversy is fully set forth in Wiley's book. Its importance here lies in the fact that it demonstrates not only the fact, but the notoriety of the fact, that fusel oil goes with the vapors as long as they are 50% water and 50% alcohol, and appears in the distillate, whereas, when the vapors are concentrated to a greater extent than 85, as set forth in the Schneible patent, they are excluded from the vapors and must remain behind, and ultimately find their way into the residue, unless trapped out at some point, as is ordinarily done in rectification.

In other words, it is perfectly notorious that in distilling for a 50% alcoholic strength distillate, as Block does, the fusel oil will be in the distillate, whereas, in distilling for a 90% alcoholic strength distillate, the fusel oil remains behind in the residue. This also is a perfectly plain and established fact, and can be fully appreciated from the literature, without any discussion whatever of the theory. This literature alone, without reverting to the more theoretical, and from a physical point of view more interesting, considerations, should dispose of the right of Block to make these claims.

It is when we take the next step, of accounting for the fact that the fusel oil of high boiling point passes off with a liquid of low boiling point and turns up in the distillate, that the abstruse character of this case appears. The fact is plain; but its explanation is not. Amyl alcohol, the principal ingredient of fusel oil, has a boiling point of 132° C., whereas, ethyl alcohol has a boiling point of 78° C., and water 100° C., a 50% mixture of ethyl alcohol and water having an intermediate boiling point of about 86° C. In other words, we find that in a fractional distillation process resulting in a distillate of about 86° C. boiling point, the entire quantity of amyl alcohol, having 132° boiling point, passes over with the distillate. The fact is not only

demonstrated by the literature already set forth, but by a considerable amount of additional literature which examines this rather curious phenomenon quantitatively. One of the early investigators of this phenomenon was Guillaume, three of whose patents are set forth in the motion papers. These patents clearly show the recognition of the fact that in the distillation from water and alcohol, containing a relatively small quantity of amyl alcohol or fusel oil, the amyl alcohol or fusel oil always passes off very early, being much more concentrated in the vapors than in the liquid.

This is fully illustrated in the German Publication cited and translated in the motion papers. The chart forming a part of this publication is most illuminating, since it shows that the amyl alcohol is always more concentrated in the vapor phase than in the liquid phase, for all percentages of alcohol and water, up to nearly 50% alcohol; and its relative concentration in the vapor phase falls sufficiently far below that of the ethyl alcohol to permit successful fractionation only at very high concentrations of the ethyl alcohol. The same general fact is indicated, although not so forceably, on page 128 of the Department of Agriculture publication entitled "Manufacture of Denatured Alcohol," in which it is shown that in distilling in a pot still, the

fusel oil comes over very rapidly in the early part of the distillation, even though the distillate is of relatively high concentration, nearly 80% alcoholic strength, and is practically all over before a 50% strength is reached. The top pan of Block's still is, of course, performing exactly the work of a pot still, delivering a 50% alcoholic strength distillate. And since in a pot still fusel oil goes over more rapidly than with a higher percent distillate, it is apparent that even the top pan of the Block still could not operate as a successful retainer of fusel oil.

The same phenomenon is investigated mathematically in the "Chemical Age," of May 1, 1920, published in England. The article contains a number of evident misprints in the mathematical formulae, the character ÷ being persistently used in place of the character +, and one or two other evident mistakes being made by the printer. This article fully discusses the phenomenon, showing that in distilling from a 25% alcoholic strength liquid, in which there is a small quantity of amyl alcohol, the amyl alcohol is five times as concentrated in the vapor as in the liquid phase, and that even in distilling from a liquid of 50% alcoholic strength, the amyl alcohol is more concentrated in the vapor than in the liquid phase, this last figure being slightly higher than the one

given in the German publication. This type of literature examining this particular phenomenon, of course, demonstrates that Block's process must do exactly what we say, and what the Schneible patent asserts, remove the higher boiling products with the distillate. It likewise demonstrates that when the distillate is made of sufficiently high alcoholic concentration, the reverse action will occur, that is, the fusel oil will exist in a smaller per cent in the vapor than in the liquid phase, thus establishing the condition required for fractional distillation, and from that time on the ethyl alcohol can be distilled out of the fusel oil, leaving it behind.

We assume it to be evident that the necessary condition for fractional distillation is that the low boiling products shall pass into the vapor phase in greater proportion, and the high boiling products in lower proportion than they exist in the liquid. When this occurs, each subsequent condensation of the vapors will produce a distillate higher in the low boiling constituents and lower in the high boiling constituents than the original charge, each subsequent redistillation thus concentrating the low boiling product in the distillate and the high boiling product in the residue. When, as is the case of amyl alcohol in a solution like beer, this condition is reversed and the high boiling product vaporizes relatively more rapidly than the low boiling product, then fractional distillation is impossible. The fact is, that it is impossible to distill water and alcohol out of amyl alcohol, leaving that behind. But the ethyl alcohol will distill out of the water, becoming more and more concentrated, and when it becomes sufficiently concentrated, it can then distill out of the amyl alcohol precisely as stated in the Schneible specification.

The theoretical reason for this action has not been very fully investigated, but it is known to arise from the fact that while ethyl alcohol and water are miscible in all proportions and seem to have rather an intense affinity for each other, amyl alcohol is only slightly soluble in water, although it is readily soluble in all proportions of ethyl alcohol. Thus, as long as the minute quantity of amyl alcohol (for it is always minute) is in a liquid principally water, it behaves like an immiscible liquid, whereas, when it finds itself in a liquid principally alcohol, it behaves like a miscible liquid, and fractional distillation occurs in accordance with the respective boiling points.

The distillation of immiscible liquid has been very fully investigated and can be found described in most works on physics. Two immiscible liquids simply add their vapor pressures, and do not have a boiling

point intermediate the two, but have a boiling point below that of either, and each one evaporates into the vapor of the other as if it alone were in a vacuum. Thus, when beer, containing a small trace of amyl alcohol, is heated nearly to the boiling point, steam begins to form, the amyl alcohol present evaporates into the steam as if in a vacuum, and the steam acts as a carrier precisely the way steam acts as a carrier in the steam distillation of oils, carrying off the amyl alcohol far below its own boiling point, precisely the way that steam blown through kerosene carries off kerosene vapor, although the kerosene has a boiling point vastly above that of water. Nor will any precipitation or condensation of the amyl alcohol occur until so much of the water has been condensed as to leave the atmosphere completely saturated with amyl alcohol at the particular temperature. It is thus perfectly apparent, on empirical grounds, that the evaporation from beer of a very little water will necessarily carry away all of the fusel oil, and that fusel oil will stay with the vapors until the vapors are so reduced in quantity as to be totally saturated with amyl alcohol vapors. But the amyl alcohol is exceedingly minute in quantity, and it could not begin to condense, unless practically all of the vapors were condensed with it, or unless the amyl alcohol was washed out by some

good solvent of it, such as pure ethyl alcohol. Now, in the Block still, according to his own figures, he distills off 40 to 70% of the still contents, in order to take away the ethyl alcohol, and he takes out of the still 6% of the original content as a final distillate, so that of the total vapors passing off of the beer, he condenses only about 9/10. The amyl alcohol, however, is but a trace, and, of course, condensing the vapors by 9/10 of their original volume would still leave the remaining 1/10 (of which half is water vapor) far from saturated with amyl alcohol, so that there could be no condensation of amyl alcohol. And it has already been shown that the 50% alcohol and water mixture is not a good solvent of amyl alcohol, so that the top pan of the Block Bubble Tower could not possibly scrub out of the vapors the amyl alcohol, and it would, therefore, of necessity, go into the distillate, just as we find that it does.

The difference in the Schneible process is that in the upper part of his column he has ethyl alcohol approximating 90% concentration, and this is a most excellent solvent for fusel oil, in which it is miscible in all proportions and from which the ethyl alcohol can be fractionally distilled. In other words, at the top of the Schneible column there is what we may term a "solvent dam" for amyl alcohol, a zone

in which ethyl alcohol is so concentrated as to scrub the amyl alcohol out of the rising vapors, and in which zone true fractional distillation occurs, the amyl alcohol and other ingredients of the fusel oil remaining behind.

Since these products accumulate near the upper part of the column where the ethyl alcohol is distilled away, the vapors in that part of the column presently become saturated with amyl alcohol, and as distillation proceeds this saturated zone gradually works down through the column until the whole space is saturated with amyl alcohol vapors. It is then perfectly evident that no further amyl alcohol can remain in the column, and must be returned to the beverage, for as soon as an added increment enters the saturated atmosphere and is cooled to the slightest degree, it will condense and run down, and, since the atmosphere is saturated, there will be no tendency to re-evaporation. It is to be borne in mind that the Schneible column is of a peculiar character, having only baffle plates of a special and unusual form. It has no trays or bubble pans on which liquid can accumulate, and therefore the Schneible column will begin to return fusel oil as soon as the vapor space above is saturated. It is not difficult to calculate approximately how long it will take for this vapor space to become saturated, be-

cause the fusel oil, being immiscible with water, evaporates into the space as if into a vacuum. A liquid on vaporizing expands in the order of 1500 times at atmospheric pressure, but at a three pound pressure, such as prevails in the Schneible apparatus, it will expand in the order of 7500 times. But of the three pound pressure existing in the column, after saturation with amyl alcohol, not as much as a pound is due to amyl alcohol, so that a given volume of amyl alcohol is capable of saturating from 20,000 to 30,000 times its own volume of column space at the temperature and pressure prevailing within the Schneible column. The fusel oil in whisky is, as a very minimum, about 100 parts in 100,000 based on a 100° proof. Beer, however, is about 1/16 of the alcoholic strength of whisky; therefore will it contain, as a very minimum, 16 parts in 100,000 of fusel oil. Now, since each part of fusel oil, as has been shown, is capable of saturating from 20,000 to 30,000 times its volume of space in the column, the fusel oil in a gallon of beer, which is 16/100000 gallons, is capable of saturating 20,000 times 16/100000 gallons, or roughly, 3.2 gallons of column space. Now, assuming that the tower has approximately a 50 bbl. capacity (as have those now in practical use), and that it is run at the rate of 20 bbls. an hour, then it will take a little less than two hours to satu-

rate the interior of the entire column with amyl alcohol vapors, so that the fusel oil will begin to return to the beverage. Of course, it will actually be somewhat less, because the extreme top of the tower has practically only ethyl alcohol vapors in it. The point, however, is that after a run in the order of a couple of hours in duration, it can be seen, on theoretical grounds, that the peculiar type of column used by Schneible will be saturated with amyl alcohol vapors and the return will commence.

On the other hand, in the Block apparatus, even if it were arranged to operate a given 90% alcohol as a distillate, there could never be any amyl alcohol returned until the liquid-containing bubble pans became very largely filled with amyl alcohol. It has already been shown that under the high vacuum prevailing in these towers, a given liquid volume of amyl alcohol is capable of saturating about 20,000 times as much vapor space, and, therefore, any system requiring the accumulation of liquid amyl alcohol before it is returned, necessitates the accumulation of 20,000 times as much as would be needed with a vapor space only being saturated.

If we assume that the Block still is of the same dimensions as the Schneible still; that only 20% of its volume is liquid in the pans (a very conservative estimate), and that only 20% of the pans have

to be filled with amyl alcohol before return commences, it will still be apparent that a perfectly enormous volume of beer must be distilled before enough liquid amyl alcohol has accumulated to produce a return. Under the assumption made of 20% of a 50 bbl. column with 10 bbls. of liquid, of which 2 bbls. must be amyl alcohol, it would be apparent that there could be no possible return of amyl alcohol to the beverage until enough beer had been distilled to yield 2 bbls. of liquid amyl alcohol. Now, since the beer contains in the order of 16 parts in 100,000, it will be evident that it would be necessary to distill over 12,000 bbls. of beer before 2 bbls. of amyl alcohol could be accumulated. Of course, this would mean that before a liquid pan bubble tower of the Block type could begin to return amyl alcohol, or any other like product occurring in such small quantities in the beer, it would have to run for a month or so before the result set forth in the counts could possibly begin to occur. Furthermore, when it did begin, if it ever did begin, to occur from a liquid pan, the fusel oil would certainly go back in slugs, causing tremendous irregularity of its distribution through the product, with, undoubtedly, unfortunate results. To secure proper results the very minute quantity of fusel oil in each gallon of beer must be replaced in the same proportion as it

came out, and this can only be done by the exceedingly delicate saturated vapor rectifying column in which there is afforded no opportunity for the collection of liquid aggregates.

Therefore, even if the Block rectifier were made to deliver 90% alcohol, the Block application could never be said to meet the counts or to disclose them, for the reason that because of the liquid pan construction, as shown, the process might be run for weeks without ever accomplishing the result specified of returning the "high boiling products," and should the still be run discontinuously, with an occasional cleaning out of the column, the result never would occur. If the result ever did occur, it would be in such an irregular fashion as to be highly detrimental and disadvantageous, and would doubtless lead to frequent emptying of the column to prevent the result. It is to be particularly noted that the Block application provides drain pipes 30 for draining the whole column, and the mere presence of these pipes with the suggestion of draining completely negatives the possibility of practicing the Schneible process for the next several thousands of barrels of beer treated after the draining. It is thus apparent that, passing by all the other points, the Block process of the counts would be, under the most favorable conditions, a pure accident, depend-

ing upon how frequently the column is cleaned out. Obviously, no such possibility of an accidental occurrence of the process is an adequate disclosure to the art.

It will, therefore, be seen that the present motion should be granted upon any of the several theories. First, the Block application is totally devoid of verbal disclosure, and the process actually described by Block is one which the Schneible patent says will not accomplish the result. Second, it is perfectly apparent that Block's distillate is substantially whisky and, therefore, must have the fusel oil content of whisky, since it is made of the same material and in the same way, and therefore the fusel oil cannot be returned to the beverage. Third, it is established by the literature, treating the subject in a theoretical way, that it has long been known that in spite of its higher boiling point, amyl alcohol does pass off with the initial fractions of the distillate, and that it can only be left behind in a high-grade rectifying process producing a high percentage of alcohol in the distillate. Fourth, the theoretical consideration of amyl alcohol, an immiscible liquid with water, but miscible with ethyl alcohol, demonstrates that it is impossible for the amyl alcohol to be arrested, except by a scrubbing zone of practically pure ethyl alcohol, constituting what we

have termed a solvent dam, and no such thing can exist in the Block process, whose ultimate distillate is 50% alcohol and water. Fifth, aside from all these considerations, the Block rectifier is of the bubble pan type, which would require a colossal quantity of beer to be treated before it could commence to function, so that if the Schneible process is performed, it is only accidentally and irregularly performed, depending upon the frequency with which the structure is cleaned.

The foregoing is the gist of our case. There remains only to answer the possible contention of our opponents, that in some manner the well known facts of physics, necessarily producing the result stated, are modified by the presence of the high vacuum. At the outset let it be noted that the Block specification is absolutely devoid of pressure or temperature limitations, the only statement being that the work is done under a vacuum. In some claims inserted after the application was filed and without supplemental oath, or any additional description, it was stated that the distillation takes place at 50° C., but there is no disclosure whatever of this fact in the specification. Of course, Block, without better disclosure than this, can have no benefit of any particular pressure, and yet we may as well meet him on the assertion of the amended

claims. Assuming that the beer has the same boiling point as water (and practically this is nearly true), this would correspond to a vacuum of 26½ inches of mercury, or a pressure of a trifle under 2 pounds absolute. Schneible, on the contrary, operates at 3 pounds absolute in the bottom of the heater, and 2 pounds absolute in the fractionator. However, it is in the fractionator that the separation of the amyl alcohol must occur, so that the conditions in the two fractionators as to pressure are almost identical. Block can scarcely claim that whatever trifling difference in pressure there may be would produce any fundamental difference between the Schneible apparatus and his own, and Schneible's assertion in the patent is that, even with his high vacuum, the ordinary rules of distillation prevail, and there will not be a proper separation of the high boiling products until there is 85% alcohol distillate.

However, it is apparent, on theoretical grounds, that the presence of the vacuum can make no difference whatever as to the separation, but will make a difference only in the temperature at which the process is conducted and the speed with which the space within the column can become saturated. Under high vacuum, vapors expand, and, therefore, saturate the vapor space more quickly.

We have had prepared a chart showing in convenient form the vapor pressures at different temperatures of ethyl alcohol, water and amyl alcohol, the source of the figures being shown upon the chart. This chart shows that the vapor pressure curves of the three substances draw nearer together at the lower temperatures, so that, at the lower pressures, the boiling points of the three liquids are slightly closer together. So far as there is any change whatever, it is thus in a direction tending to make separation by distillation more difficult rather than easier. This is in accordance with the universal experience of distillers, and is absolutely sound in principle. All vapor pressure curves must, as a matter of physical theory, converge and meet at the absolute zero, since that is the point where molecular motion must cease, and at every temperature above the absolute zero, there must be a theoretical vapor pressure, and the vapor pressure must increase with the temperature. Since all vapor pressure curves must converge toward the absolute zero, we naturally expect them to converge toward each other as the temperature drops. This is exactly what we find. Gaps between different boiling points of liquids decrease with decreased pressure, and increase with increased pressure, and it is upon these gaps that fractional distillation depends, so

that fractionation is slightly less effective at low pressure. There is no sound physical reason, nor can any be suggested, why the three liquids shown in this chart should behave essentially differently at 2 pounds absolute, than when at 14.7 pounds absolute, and any suggestion by Block of this kind must necessarily be pure assertion, unfounded either in physics or good sense. Certainly the miscibility of amyl alcohol in the other two liquids does not and cannot change in the slightest degree with changes in pressure.

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